Instalační manuál pro krysta-

lické křemíkové fotovoltaické

moduly

ASTRONERGY

Katalog

1 Úvod

Děkujeme vám za důvěru a spolehnutí se na produkty fotovoltaických modulů vyráběných společností Astronergy
.

Před instalací si pečlivě přečtěte všechny pokyny a elektrické a mechanické požadavky uvedené v tomto manuálu. Pro instalaci a provoz fotovoltaických modulů jsou vyžadovány specializované dovednosti a tuto úlohu mohou provádět pouze profesionálové. Při instalaci je nutné přísně dodržovat všechna bezpečnostní opatření uvedená v tomto manuálu a manuál je třeba správně uchovávat pro další použití. Instalatér musí informovat koncového zákazníka (nebo spotřebitele) odpovídajícím způsobem.

1.1 Účel

Tento dokument poskytuje podrobné pokyny a bezpečnostní opatření týkající se instalace, elektrického připojení a údržby následujících fotovoltaických modulů vyrobených společností Astronergy:

Tabulka 1 Tento manuál se vztahuje na typy fotovoltaických modulů

CHSM54M-HC	CHSM54N-HC	CHSM54M/LV-HC
CHSM54M(BL)-HC	CHSM54N(BL)-HC	CHSM54M(BLH)-HC
CHSM54N(BLH)-HC	CHSM60M-HC	CHSM60N-HC
CHSM60M/LV-HC	CHSM60M(BL)-HC	CHSM60N(BL)-HC
CHSM60M(BLH)-HC	CHSM60N(BLH)-HC	CHSM66M-HC
CHSM66N-HC	CHSM66M/LV-HC	CHSM72M-HC
CHSM72N-HC	CHSM72M/LV-HC	CHSM72M(BL)-HC
CHSM72N(BL)-HC	CHSM72M(BLH)-HC	CHSM72N(BLH)-HC
CHSM78M-HC	CHSM78N-HC	

1.2 Rozsah odpovědnosti

Vzhledem k tomu, že způsob, jakým je tento manuál sestaven, je mimo kontrolu společnosti Astronergy, nejsou poskytovány žádné výslovné ani implicitní záruky ohledně jakýchkoli informací v tomto manuálu. Společnost Astronergy nenese žádnou odpovědnost za jakoukoli formu ztráty, včetně, ale neomezeně na ztrátu, poškození, újmu nebo dodatečné náklady způsobené nesprávnou instalací, provozem, používáním a údržbou fotovoltaických modulů a systémů.

Společnost Astronergy si vyhrazuje právo aktualizovat tento manuál bez předchozího upozornění. V případě nesrovnalostí mezi popisem různých jazykových verzí tohoto manuálu má přednost čínská verze.

2 Pravidla

Mechanická instalace a elektrické připojení fotovoltaických systémů by měly být prováděny v souladu s místními zá kony, předpisy a příslušnými mezinárodními a domácími normami, včetně elektrických kódů, stavebních předpisů a požadavků na elektrické připojení.

Takové požadavky se mohou lišit v závislosti na různých místech instalace, například na střešních systémech a plovoucích systémech.

Požadavky se mohou také lišit v závislosti na napětí systému a pro DC/AC aplikace. Pro podrobné informace o platných předpisech se obraťte na místní orgány.

3 Bezpečnostní opatření

- Moduly Astronergy jsou navrženy tak, aby splňovaly požadavky normy IEC61215 a IEC61730 a byly schváleny pro Aplikační třídu A (ekvivalent bezpečnostní třídy II)
  .

  Moduly lze použít v systémech, které jsou veřejně přístupné a pracují s napětím vyšším než 50V DC nebo 240W.

- Návrh modulu je v souladu s normou IEC61730 a

UL61730 a splňuje požadavky na požární třídu C (IEC 61730) a požární třídu 4 (UL61730).

! VAROVÁNÍ

Před instalací, připojením, manipulací a/nebo údržbou fotovoltaických modulů si přečtěte a porozumějte všem bezpečnostním pokynům. Fotovoltaické moduly generují stejnosměrný elektrický proud, když jsou vystaveny slunečnímu světlu nebo jiným zdrojům světla. Přímý kontakt s živým částem modulu, jako je připojovací svorka, může způsobit osobní zranění nebo dokonce smrt, bez ohledu na to, zda je modul připojen nebo ne.

3.1 Obecná bezpečnost

- Před instalací se prosím obraťte na příslušný místní orgán, abyste se ujistili, že povolení k instalaci a požadavky na inspekci instalace splňují místní požadavky. Instalační proces by měl splňovat bezpečnostní pravidla platná pro všechny komponenty systému, včetně kabelů, terminálů, nabíjecích monitorů, baterií , měničů, atd.
- Installation and maintenance must be completed by professionally qualified engineers. During the installation, wear safety helmets, insulating gloves, safety shoes and use insulating tools to avoid the direct contact with a DC voltage of 30V or even higher.
- During the installation and turnover of modules at the Project place，The rainproof measures should be taken to prevent the outer box from getting wet.
- When installing or operating PV modules on rainy days or dewy mornings, take appropriate protective measures to prevent moisture from penetrating the connectors.
- Unauthorized personnel are prohibited from approaching the installation area or PV module storage area.
- It is forbidden to install or use damaged PV modules.
- It is forbidden to repair PV modules by unauthorized personnel, including but not limited to replacing any part of PV modules (such as diodes, junction boxes, connectors, etc.).
- It is forbidden to plug in connectors of different types and models.
- It is forbidden to expose PV modules to the following substances: grease or organic ester compounds (e.g. DOP, plasticizers), aromatics, phenols, ketones, halogenated substances, mineral oil, alkanes (e.g. gasoline, cleaning lubricants, electronic resurrection agents), alcohol, , adhesive sheets that can generate oxime gas and potting glue (only for connectors), TBP (plasticizer), detergent, etc., to avoid chemical damage and affect the electrical safety performance of PV modules.
- Photovoltaic module installation is prohibited on windy days.
- Avoid focusing sunlight on PV modules.
- It is forbidden to place PV Modules where flammable gas may be generated.
- It is forbidden to install PV modules on movable platform, excepting tracking systems.
- It is forbidden to disassemble and move any part of the PV module; if the connector of the PV module

is wet, do not perform any actions to avoid the risk of electric shock.

- It is forbidden to connect or disconnect the PV module when there is electrical current or external electrical current.
- The cover of the junction box shou ld always be kept closed.
- Avoid partial shading of PV modules for a long period of time, otherwise the temperature of the shaded module may rise due to hot spot effect, burning the module and causing fire hazard in severe cases.
- For photovoltaic modules that are use d in deserts, windy and sandy areas , water surfaces, or need long-term transportation and storage, it is recommended to use connector dust caps before installation, or adopt other measures to avoid sand and dust entering the connector, ot herwise it may cause plugging problems or electrical safety hazards.
- After the modules ar e installed on the rack, it is recommended to plu g in the connectors on the same day to prevent moisture or wind and sand from invading, causing mating or use problems.
- For wiring conn ections, please use standard PV copper wires with a cross -section area of at least 4mm2, and should be light-resistant and temperature-resistant at a minimum of 90℃.

3.2 Operation safety measures

- Avoid package damaging and falling during transportation and storage. Ensure the packing cases are well ventilated, water-proof and dry. After the arrival, carefully open the outer package and prevent scratches and bumps of PV modules. When stacking PV modules, strictly follow the stacking requirements in chapter 4.3.
- Avoid impact or scratches on any part of th e PV module, otherwise the reliability and safety of the PV module will be affected; standing or walking on the PV modul e is prohibited; at the same time, in order to avoid glass damage, it is forbid den to apply excessive load or distorted PV modules.
- Do not install or carry PV modules by one person. It is forbidden to pick up, drag, or move PV modules by grabbing the junct ion box (including the box body, cables, and connectors); when placing a PV module on a flat surface, it must be operated carefully and be aware of bumps in the corners.
- When installing or repairing the PV system, do not wear any metal accessories to avoid the risk of electric shock; if it is installed far above the ground, please wear a seat belt.
- When operating PV modules in the sun, please use insulated tools, and wear rubber gloves and protective clothing. At the same time, in order to avoid the risk of arc and electric shock, do not directly touch the junction box and the end of the output cable (connector) with bare hands.
- For electrical connection, choose a dry and weak-light morning or evening; or use opaque materials to completely cover the surface of the PV modules to prevent current generation.
- A certain distance between the PV module and the installation surface should be kept to prevent the installation surface from touching the junction box.

- When installing on the roof, comply with the fire protection requirements of the building. It is recommended to install PV modules on a fireproof and insulated roof covering, and ensure adeq uate ventilation between the PV modules and the installation surface. In order to ensure the fire rating on the roof, the minimum distance between the frame of the PV module and the roof surface is 10cm.

- The connector must be fully mated when wiring. If the cable is too long, it is recommended to fix the cable to the rack system with a UV-resistant nylon cable tie. When fix ing the cable to the rack, the bending radius of the cable should be not less than 48mm.

- Avoid directly exposing cables and connectors t o sunlight. Please use anti-UV cables.

- Do not disconnect the electrical connection when there is a load.

- It is strictly forbidden to try to disassemble the PV module, and it is strictly prohibited to remove the nameplate of the PV module or other parts on the PV module; it is strictly forbidden to paint or apply any adhesive on the surface of the PV module.

- It is strictly forbidden to drill holes in the frame of the PV module.

- It is strictly forbidden to scratch the anodized layer on the surface of the aluminum alloy frame, except when it is connected to the ground. Scratches may cause corrosion of the frame, affecting the f rame's load-bearing capacity and long-term reliability.

- If the PV module glass or other packaging materials are damaged, please wear personal protective equipment to separate the PV module from the site or the circuit. It is strictly forbidden to touch wet PV modules, unless you are wearing electric shock protection equipment that meets the requirements.

- When professionals replace or repair PV modules, do not damage the surrounding PV modules or their support structures.

- When cleaning PV modules, you must f ollow the cleaning requirements of PV modules.

- The connectors must be kept dry and clean to ensure that they are in good working condition. Do not insert other metal objects into the connector or make electrical connections in any other way.

4 Handling, unloading and unpacking

- If the PV module is not in use, please do not open the product packaging. The goods should be stored in a dark, dry and ventilated place. If the PV modules are stored in an uncontrollable environment, the storage time must be less than 3 months when the outer packaging of the PV modules is kept intact.

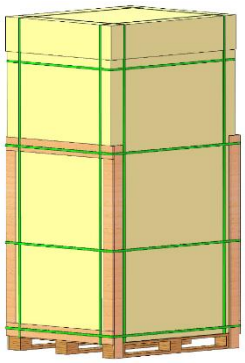
- It is recommended to unpack an appropriate number of PV modules per day according to the project progress, and the unpacked PV modules should be installed within a day. If unpacking too many PV modules and being stacked on the ground, in severe weather such as heavy rain and typhoons, the PV modules may be immersed in wate r for a long time affecting the reliability of the product or be scraped away.

4.1 Transport and unloading

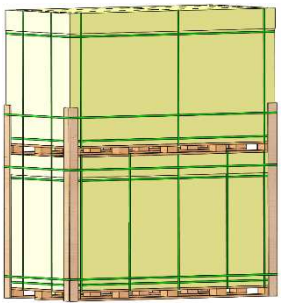
During the transp ortation of the PV modules to the project site, they must be packed in the packaging box provided by Astronergy, and they should be stored in the original packaging box before installation. Please protect the packaging from damage.

It is necessary to ensure the safety when unloading PV modules, especially when hoisting roof projects. The PV modules should be placed in a protective device and then hoisted to the roof to prevent the packing box from deforming and bumping against the wall during the hoisting process.

There are two packaging methods for Module of 210mm-wafer, vertical po rtrait package and vertical landscape package. The requir ements for unloading and unpacking are also different. The packaging method is as follows:



Vertical portrait package



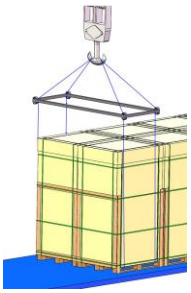
Vertical landscape package

Matters needing attention for unloading with crane:

1. Use specialized equipment for crane operation. Select suitable hoisting equipment with enough strength according to the weight and the size of the load. Adjust the position of the sling to ensure the center of gravity is stable and keep moving at a stable speed. Place the package lightly on a flat ground and right the package.

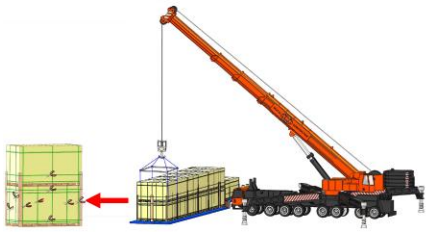
2. Do not unload the modules under conditions of wind over class 6, rain and snow.

3. For vertical portrait packages, do not lift up more than 2 pallets of modules at once. For verti cal landscape packages, do not lift up more than 2 pallets of modules at once. For lateral unloading , remove the pallet stacking belts before unloading.



Hoisting equipment

Vertical portrait package unloading with crane



Vertical landscape package unloading with crane

Matters needing attention for forklift unloading:

1. Unload from both sides of the truck.

2. Select a suitable tonnage forklift according to the

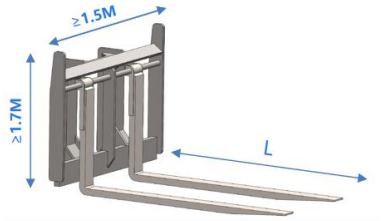
module weight, the fork distance should be adjusted to the maximum position without any interference to the pallet, the forks should go into the pallet at least 3/4 of the pallet depth during unloading(the forks length L ⩾3/4 of pallet length),the backrest height should be not less than 1.7m and the backrest width should be not less than 1.5m.

3. The contact position between the backrest and the module package should be fixed with a buffer material (preferably silicone, rubber, EPE) to prevent the forklift from damaging the modules.

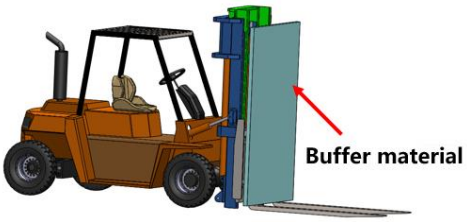
4. Since the packing box will block the sight of the forklift driver, it is recommended to drive backwards during the forklifting, and arrange for special supervision and command to prevent bumping in to people or items causing personal injury or damage to the modules.

Vertical portrait package unloading with forklift

Vertical landscape package unloading with forklift



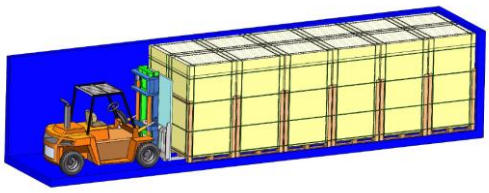
Backrest: height ⩾ 1.7m, width ⩾ 1.5m



Cushion materials in front of the backrest

! Special instructions

Due to the limitation of t he height of the container, when the photovoltaic modules are removed from the container, the distance between the upper surface of the forklift tines and the ground should be less than 50mm, otherwise collisions may easily occur, which may damage the phot ovoltaic modules. Unload the front-most package in turn.



Unloading from container

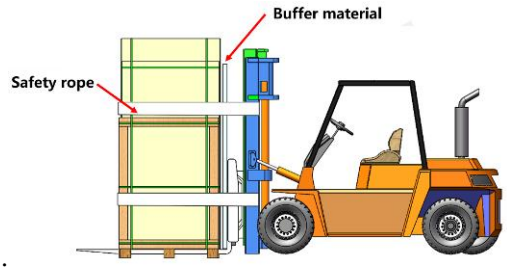
Packaging turnover points are as follows:

1. When transporting the vertical portrait packages, the entire module package shall prop against the backrest, backrest shall perpendicular to the fork, and the structure must be firm (withstand

pressure ⩾1.5 ton). When the entire module package leans on the backrest, the backrest shall not be deformed due to the pressure. the package must be fixed using a safety rope with tensile strength of ⩾ 2000kgf, and place safety guardrail on both sides of the forklift.

2. The forklift should be driven at a controlled speed of ≤ 5 km/h in straight, and ≤ 3 km/h for turning, so as to avoid sudden stop and rapid start.

3. When using the hydrau lic vehicle to transport the modules, the distance between the upper surface of the fork and the ground should be less than or equal to 75mm.



Forklift operation

Distance between the upper surface of the forklift tines and the ground

4.2 Unpacking

Before unpacking, please make sure that the packaging box is in good condition, it is recommended to use art knife to remove the packing belt and wrapping film. Violent removal is prohibited to avoid scratching the modules in the box. It is strictly prohibited to unload modules under the weather conditions of wind speed greater than Level 6, heavy rain or heavy snow.

Please follow the recommended unpacking steps to unpack the modules. When unpacking, it mustbe operated by two or more people at the same time.

Always wear insulating gloves when handling the modules.

If the unpacked modules are not installed immediately, they should be fixed to the stand supporter with a safety rope. When the modules need to be temporarily stored after unpacking, they should be neatly and stably stacked on two pallets of appropriate size, the number of stacked modules should not exceed 14.

1. Prepare the following tools before unpacking: art knife (scissors), safety hat, stand supporter, safety shoes and anti-cutting gloves.

Safety helmet

Pen knife

Stand supporter

2. Stand supporter must be us ed for vertical portrait package unpacking, and the steps are as follows:

1) Remove the packing belts, wrapping film, top cover and carton box.

2) Place the stand supporter into th e bottom of the pallet from the glass or backsheet side

3) Insert fixed bolts into the front hole of the support.

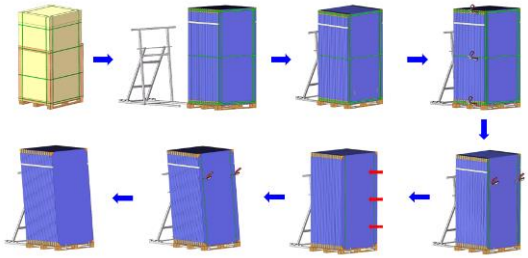
4) Cut off the horizontal packing belts.

5) Cut off the vertical packing belts excepting two inner belts.

6)push the module gently to tilt tow ards the stand supporter.

7) Cut the remaining packing belts.

8) Tear off the anti-fallen tape on the first module in the front, and then take out the modules in order.



Vertical portrait package unpacking steps

3. A fixed support (wall, rack, stable unpacked module pallets, etc.) must be ready for vertical landscape package unpacking, and the steps are as follows

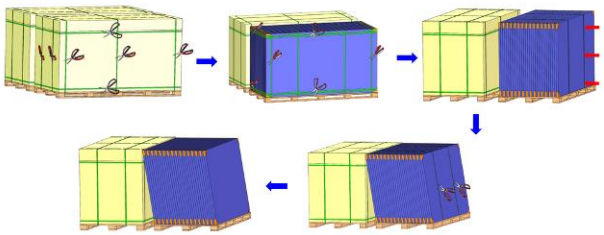
1) Remove the packing belts, wrapping film, top cover and carton box.

2) Cut off the horizontal packing belts.

3) Cut off the vertical packing b elts excepting two inner belts, then push the module gently to tilt towards the stand supporter.

4) Cut the remaining packing belts.

5) Take out the modules in order.



Vertical landscape package unpacking steps

4.3 Stack

When taking out the PV module from the packing box, put the cardboard on the ground first to prevent the PV module from colliding and scratching with the cement surface, hard object on the ground, col or steel tile, metal corrugated, etc.

When the PV modules are stacked, they must be neatly and stably stacked on a horizontal surface, and stacked with the glass side of the bottom module facing up, the glass side of other modules facing down. At the same time, there must be cardboard bedding under the PV modules, the number of piles should not exceed 14. At the same time, avoid installation tools and other objects on the surface of the PV module.

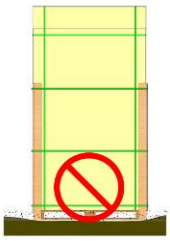
Astronergy PV modules adopt high and low current bins, and the handlers need to place them separately and mark them according to the markings on the power list on the PV module outer packaging (for example, 670W-L means low current bin; 670W-H means high current bin; the current division method required by other customers is similar); According to the system design requirements, modules of the same current bin are usually required to be installed in the same array.

If the customer requires PV modules to be distinguished by color, the outer packaging box shall be marked accordingly, and the PV modules shall be

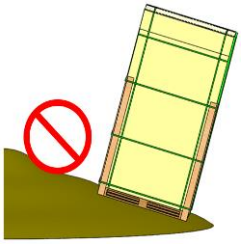
marked to prevent confusion when they are taken out of the packaging box and stacked up. According to the system design requirements, the color of PV modules in the same row or the same array should be the same.

Modules should be stored in a dry and ventilated environment on a flat ground. Do not place modules on soft ground to avoid damage or dumping of the modules due to ground deformation or collapse. Do not place modules on area with poor water drainage.

For long-term storage, it is recommended to store the modules in a standard warehouse with regular inspection, reinforce the package in a timely manner if any anomalies are found.



No soft ground and water



No inclination angle > 4°

5 Mechanical installation

5.1 Environment

- Recommended ambient temperature: -20°C to 50℃; extreme operating ambient temperature for PV modules: -40 ℃ to 85℃.
- Mechanical load on PV modules : under standard installation conditions, the maximum tested snow/wind load is 5400 Pa/2400 Pa and the design load (considering a safety factor of 1.5 times) is 3600 Pa/1600 Pa. Refer to 5.3 for detailed installation and mechanical loads.
- PV modules are strictly forbidden to be installed and used in environments with excessive amounts of hail, snow, hurricanes, sand, soot, air pollution, and etc. PV modules are strictly forbidden to be installed or used in environments where there are strongly corrosive substances (e.g. salt, salt spray, brine, active chemical vapors, acid rain, strong vapor confined environments or any other substance that will corrode PV modules and affect their safety or performance).
- If the PV modules will be installed in special environments such as high temperature and high humidity environments, humid salt-mist environments (C3+areas specified in ISO 9223), marine and floating environments and farms, the purchaser or user needs to inform Astronergy in advance. The types of PV modules, BOM, and warranty issues will be decided by mutual agreement between the parties.
- If the above precautions are not observed, Astronergy's warranty will be void.

5.2 Tilt angle selection

The tilt angle of a PV module refers to the angle between the surface of the PV module and the ground surface, as shown in Fig. 1. The power output of a PV module is maximized. when it faces the sun directly.

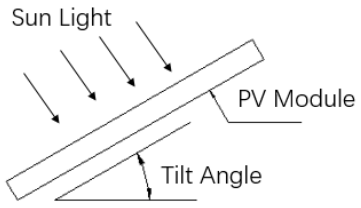


Fig. 1 Schematic diagram of tilt angle

For northern hemisphere, PV modules should preferably face south. For southern hemisphere, PV

modules should preferably face north. For detailed mounting inclination, please follow local regulatory guidelines or the recommendations of an experienced installer. Astronergy recommends an installation tilt angle of no less than 10°, so that when it rains, the dust on surface is easily carried away by the rainwater, thus reducing the number of times of clean; at the same time, it helps the water on the surface of t he PV module to flow away, avoiding the long-term accumulation of large amou nts of water on the glass surface, which can affect the appearance and performance of the PV module.

PV modules connected in series should be installed in the same orientation and angle. Different orientations and angles may result in different amounts of solar radiation being received by each module, resulting in power loss.

5.3 Mounting Guide

- PV module mounting system must be composed of durable, corrosion-resistant and UV-resistant materials, and it must be inspected and tested by a third-party testing organization with static mechanical analysis capabilities meeting national and regional regulations or corresponding international standards.

- The PV module must be securely fastened to the mounting system. If the PV module is mounted in a snowy area, the height of the mounting system should be designed in a way that the lowest end of the PV module is not covered by snow. In addition, it should be ensured that the lowest end of the PV module is not shaded by surrounding trees or other vegetation.

- When the PV module is mounted on a rack parallel to the roof, the minimum clearance between the PV module frame and the roof is 10cm, which is necessary for air circulation to prevent wiring damage of the PV module.

- The PV module frame will suffer thermal expansion and contraction effect, therefore the space between two adjacent PV module frames should be no less than 10mm when mounted.

- For special installation areas (such as high altitude, mountain tops, coastal areas, wind vents), project sites with frequent strong winds, it is recommended to use square gaskets, anti-loosening nuts, anti-loosening gaskets, thickened gaskets, etc.

- For specific installation methods, please refer to the following installation specifications, If inappropriate fixtures or incorrect installation methods are used, the warranty of Astronergy will be invalid.

5.3.1 Bolted mounting

All modules must be securely fastened with at least 4 bolts (As shown in Fig. 2, Fig. 3, Fig. 4 , Fig. 5 , Fig. 6, Fig.7 , Fig. 8 , Fig. 9). The corresponding mechanical loads are shown in Table 2.

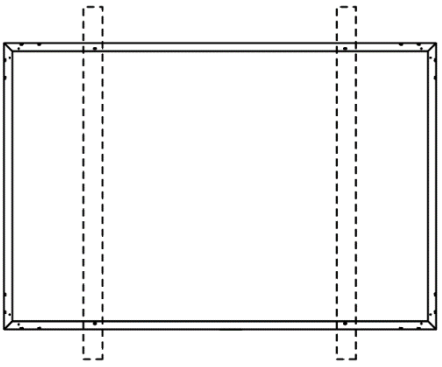


Fig. 2 Bolt installation for 54cell

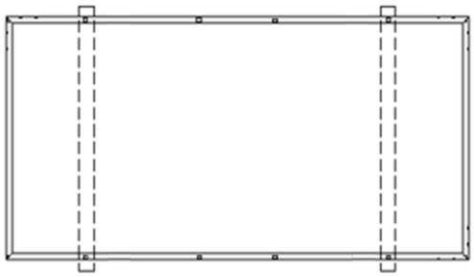


Fig. 3 Bolt installation for 60cell

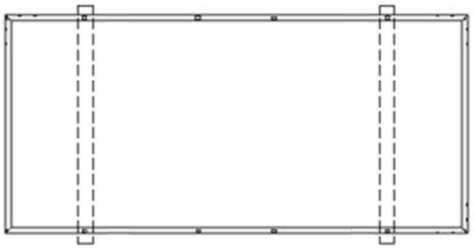


Fig. 4 Bolt installation for 66cell

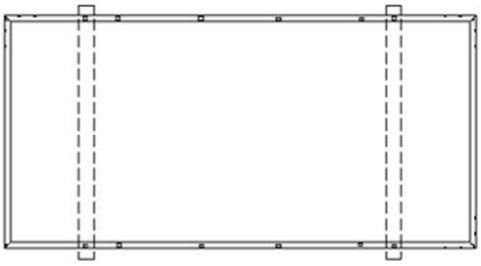


Fig. 5 Outer four-hole bolt installation for 72cell

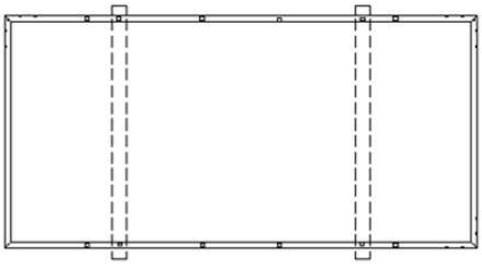


Fig. 6 Internal four-hole bolt installation for 72cell

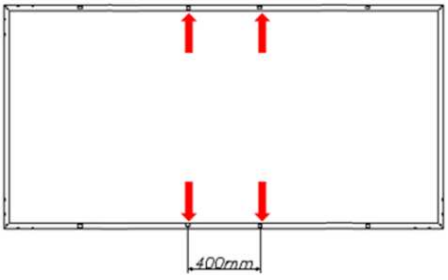


Fig. 7 60cell PV module 400mm spacing bolt installation

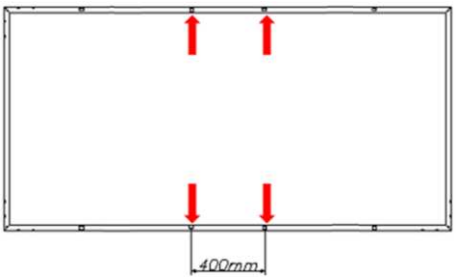


Fig. 8 66cell PV module 400mm spacing bolt installation

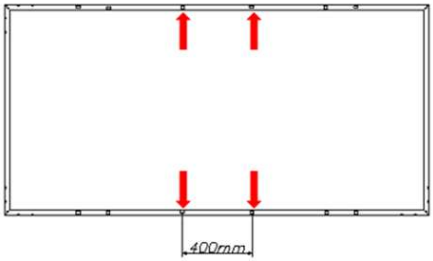


Fig. 9 72cell PV module 400mm spacing bolt installation

! ATTENTION

In order to achieve maximum safety precautions against wind and snow loads, it is recommended that all available mounting holes should be used. The bolt installation steps are as follows (Fig. 10).

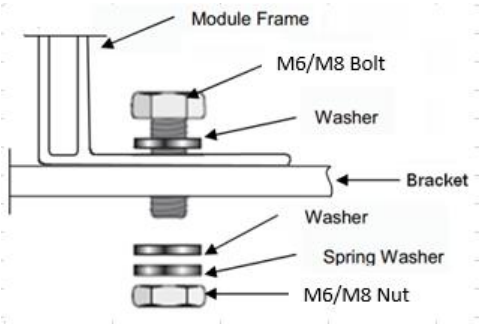


Fig. 10 Diagram of the bolt installation process

① Place the PV module on top of the rack.

② Insert 4 stainless steel bolts in corresponding mounting holes. The 9x14mm mounting holes match with M8 bolts, while the 7x10mm mounting

holes match with M6 bolts. 7x10mm mounting holes are positioned with a hole pitch of 400mm.

③ Make sure to use two stainless steel washer s for each bolt, one on each side of the rack, the minimum thickness of the washer is 1.5mm, and the outer diameter is 16~18mm, but for 210 wafer size modules, the outer diameter is 18~20mm, then screw on the top of a stainless-steel spring washer or toothed lock washer. Finally, lock with a stainless-steel nut. The tolerance requirements for flat gaskets are in accordance with the A -level standard in GB/T 3103.3-2020.

④ The tightening torque is recommended to be 9~12Nm for M6 bolts and 17~23Nm for M8 bolts. Due to the possible difference of bolt material, the specific torque value is subject to the information confirmed by the bolt supplier.

⑤ When using 30mm height frame module, it is recommended to select fasteners ≤ 20mm length.

5.3.2 Clamped mounting

Photovoltaic modules can be installed across the support frame (Fig. 11) or parallel to the frame of the photovoltaic module (Fig. 12). PV modules can also be installed with four fulcrums (Fig 13). When using clamps to install, each module must be secured with a minimum of 4 clamps.

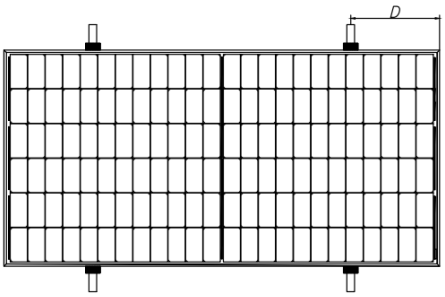


Fig. 11 Rails vertical to the long-side frame

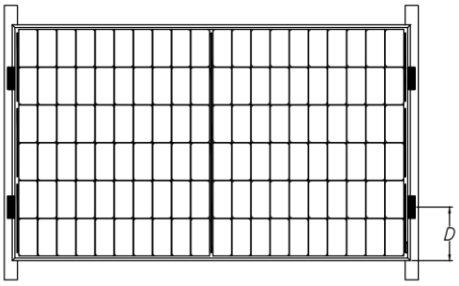


Fig. 12 Rails overlapping the short-side frame

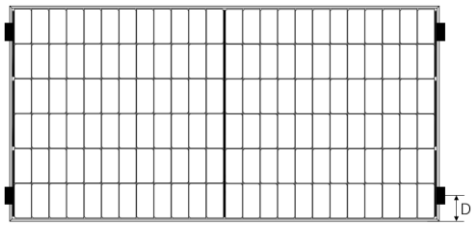


Fig. 13 Four clamp mounting on short side of frame

! ATTENTION:

- The length of the rack must be longer than the PV module, otherwise it should be confirmed by Astronergy in advance.
- The above two diagrams show the mounting method using aluminum clamps. "D" indicates the mounting range. Table 1 shows the recommended mounting position and corresponding machine loads.
- Each aluminum clamp is equipped with an M8 bolt, a flat washer, a spring washer and an M8 nut. The mounting steps are as follows:

① Place the module on the two supporting rails (not provided by Astronergy) which should be made with stainless material and treated with an anti-corrosion process (e.g. hot dipped galvanizing). Each PV module needs at least four clamps to be fixed. The module clamps should not come into contact with the glass and should not deform the frame, otherwise they may cause module damage.

② Be sure to avoid shadowing effects from the module clamps. Weep holes on the module frame must not be closed or obscured by the clamps. The clamp must have at least 8mm but no more than 11mm overlap with the frame of the module (The clamp section can be changed under the premise of ensuring reliable installation).

③ The top surface of the rail contacted with module frame should be equipped with grooves compatible with an M8 bolt.

④ If the grooves are not provided, holes of a suitable diameter may need to be drilled to allow bolts attaching to the rail at the same locations as mentioned above.

⑤ Ensure that the mounting sequence of each clamp is in the order of flat washer, spring washer and nut.

⑥ Figures 14 and 15 show the schematic diagram of the clamp, while Figures 16 and 17 show the installation schematic diagram of the clamp. The dimensions of the clamp are a≥40 mm, b≥16 mm, c≥5 mm, d ≥8 mm, e ≥15 mm, Ø =9 mm, and the thickness of the clamp is ≥ 3mm. For module of 182/210mm-wafer, the size of mid and fringe clamp must meet a ≥60 mm. The tightening torque is suggested to be 17~23Nm for Class 8.8 screw and bolts.

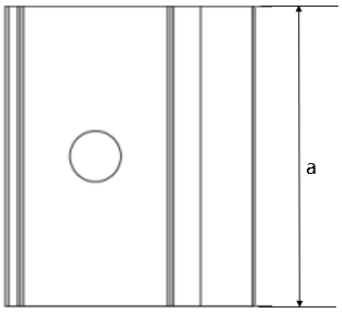


Figure 14 Top view of fringe clamp

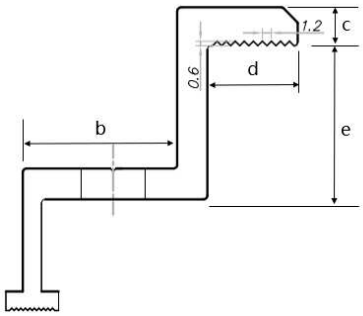


Figure 15 Cross section diagram of fringe clamp

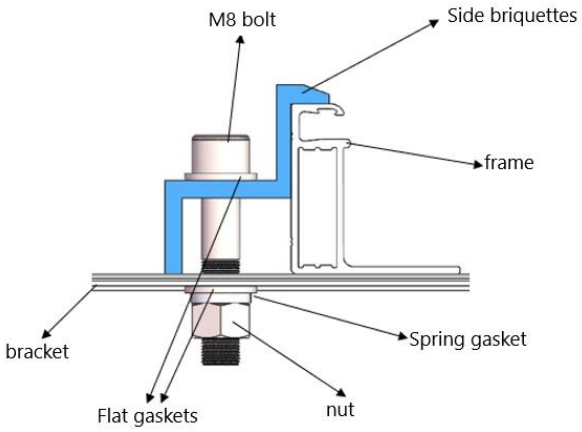


Figure 16 Installation schematic diagram of fringe clamp